

**R E M A R K S**

Regarding item nos. 1 and 2 on page 1 of the Office Action, the Examiner is thanked for returning with the December 8, 2005 Office Action copies of Forms PTO/SB/08A and PTO/SB/08B dated September 23, 2005; Forms PTO/SB/08A and PTO/SB/08B dated July 26, 2004 and Forms PTO/SB/08A and PTO/SB/08B dated March 1, 2004, with the Examiner's initials in the left column next to each cited publication, except for the Heat Treatment of Steel publication and the Komine et al. publication on the Form PTO/SB/08B dated March 1, 2004 and JP 2003-328078 on the Form PTO/SB/08A dated July 26, 2004. The reasons given for not considering these publications were that no English-language translations were provided for each of the Heat Treatment of Steel publication and JP 2003-3280078, and no date was provided for the Komine et al. publication.

Enclosed is an English-language abstract of JP 2003-328078. JP 2003-328078 is a family member of US 2004/0047757.

Also enclosed is a copy of the first page of the Komine et al. publication, which indicates that the publication date is January 15, 1977.

In view of the above, the Examiner is respectfully requested to return copies of Form PTO/SB/08A dated July 26, 2004 and Form PTO/SB/08B dated March 1, 2004 with the Examiner's initials next to JP 2003-328078 and the Komine et al. publication.

The term "case-hardened" added to the claims is supported in the specification on page 3, line 10.

Minor editorial revisions were made to claims 1, 3, 4, 6, 7, 9, 10, 13, 14 and 22.

Claim 1 was amended to include the features of original claim 2.

Dependencies were changed in claims 3 to 5 and 20.

The amendment to claim 8 involving the amount of aluminum is supported in the specification on page 34, line 22.

The amendment to claim 10 involving the gear module M is inherent from the definition thereof (see the enclosed copy of "DR Gears").

In claims 17 and 18, the term "incrassating" was changed to "concentration."

Claim 19 was amended to rearrange the format of the claim.

Claims 1 to 15, 17 to 20 and 22 were rejected under 35 USC 112, second paragraph, for the reasons set forth in item nos. 4

to 14 beginning at the bottom of page 2 and continuing to the bottom of page 4 of the Office Action.

In item no. 6 on page 3 of the Office Action, it was asserted that the "claims are indefinite because cementite is a carbide ( $\text{Fe}_3\text{C}$ ) and does not contain Cr." Applicants respectfully disagree for the following reasons. It is well-known that various alloy elements are solids dissolved in large amounts in cementite contained in a steel having alloy elements. Further, it is known that when a heat treatment in a two phase (ferrite + cementite) region is carried out, alloy elements are distributed in a specific concentration ratio as described in the present specification, and Cr is highly concentrated in the cementite.

Facts relevant to the above-described matter are described in the enclosed copy and English-language translation of the "IRON AND STEEL HANDBOOK", Third Edition, Maruzen Co., Ltd., (1981) (p142), wherein cementite is described as  $(\text{Fe},\text{M})_3\text{C}$  therein (note that M is an alloy element).

Claim amendments were made to avoid the other grounds for the 35 USC 112, second paragraph rejection.

Withdrawal of the 35 USC 112, second paragraph rejection is therefore respectfully requested.

Claims 1, 3, 6 and 7 were rejected under 35 USC 102 as being anticipated by USP 3,663,314 to Monma et al. for the reasons indicated in item nos. 15 to 19 on page 5 of the Office Action.

It was admitted in the Office Action that the prior art does not teach a quenched hardened layer containing 0.1 to 1.5 microns recited in applicants' claim 3.

Table 4 of Monma et al. (USP 3,663,314) shows samples 12 to 19 containing 0.45 to 1.17 wt% carbon and 1.44 to 1.50 wt% chromium. Each sample was quenched for 30 minutes at a quenching temperature between 810 to 870°C. The specific quenching temperature is determined depending on each alloy such that martensite parent phase of each sample has a carbon content of 0.45 wt%. The cementite content dispersed in each sample after the quenching treatment is shown.

The sample steels of Monma et al. have a Cr concentration which is rather high with respect to the carbon concentration. It is therefore expected that the Cr concentration in cementite dispersed in the steel which has been spheroidized is notably high, leading to a problem as discussed in the present specification that satisfactory hardenability is not attained when case-hardening is performed by induction hardening. According to the present specification, for example, the upper

limit of Cr is 1.8 wt% when 1.5 wt% carbon is added (1.2 times carbon content) (see page 20, lines 2 to 3 of the specification). Also, for 0.55 wt% C, 0.3 wt.% Cr is added (0.55 times carbon content) (see page 18, lines 4 to 5 of the specification). Therefore, the range of Cr content which is appropriate in the present invention satisfies the following expression:

$$0.55 \times C \text{ wt\%} \leq \text{Cr wt\%} \leq 1.2 \times C \text{ wt\%}.$$

Clearly, the alloys in the samples 12 to 19 of Monma et al. do not satisfy the above relationship.

It is clear that the appropriate relationship between the carbon concentration and the chromium concentration is achieved by defining the chromium concentration in the cementite in a range between 2.5 to 10 wt.% based on the equation on page 18 in the present specification.

In item no. 18 of the outstanding Office Action, the position is taken that Monma et al. teach an induction hardened martensitic bearing steel which would include the rolling element in addition to its rolling contact surface. Applicants respectfully disagree for the following reasons. The case-hardened rolling element obtained by induction hardening of the

present claims is not disclosed or suggested in Monma et al. As described above, Monma et al. do not disclose in their samples a method for determining the appropriateness of the carbon concentration and the chromium concentration to obtain a case-hardened layer with satisfactory hardenability by use of induction hardening.

Also in the item no. 18 of the Office Action, the position was taken that "prior austenite grains" is a past, rather than a present property and therefore not a patentable consideration. It is true that a size of the prior austenite grains is a factor in the austenite structure which has not become martensite structure. It is well known that this factor has a great impact on hardenability, toughness or endurance strength of the martensite. For example, according to "PHYSICAL METALLURGY AND THE DESIGN OF STEEL" by F.B. Pickering, Applied Science Publishers Ltd., the following is described:

"When miniaturizing austenite grains prior to transformation, martensite plate which is a result of transformation becomes advantageously small. Such a transformed product is not only strong but also superior in ductility and toughness."

Regarding samples 26 to 32 of Monma et al. (Table VII), as described in the preceding paragraph (regarding item no. 18 of

the outstanding Office Action), Monma et al. do not disclose or suggest a method for determining the appropriateness of the carbon concentration and the chromium concentration in the sample steels. Therefore, these samples differ from the present claims.

In view of the above, withdrawal of the 35 USC 102 rejection is respectfully requested.

Claims 1 to 15, 17 to 20 and 22 were provisionally rejected on the ground of obviousness-type double patenting as being unpatentable over claims 1 to 12, 20 to 23 and 25 to 27 of copending application Serial No. 10/790 959 for the reasons stated in item no. 20 on pages 6 and 7 of the Office Action.

The copending application is still being prosecuted. Therefore, it is premature at this time to determine if the filing a Terminal Disclaimer is appropriate.

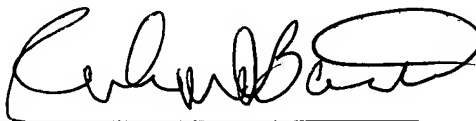
Reconsideration is requested. Allowance is solicited.

An INFORMATION DISCLOSURE STATEMENT is being filed concomitantly herewith.

If the Examiner has any comments, questions, objections or recommendations, the Examiner is invited to telephone the undersigned at the telephone number given below for prompt action.

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Respectfully submitted,



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- Encs.: (1) PETITION FOR EXTENSION OF TIME  
(2) copy of Abstract of JP 2003-328078  
(3) copy of first page of the Komine et al. publication  
(4) copy of DR. Gears  
(5) copy and English-language translation of the "IRON AND  
STEEL HANDBOOK", Third Edition, Maruzen Co., Ltd.,  
(1981) (p142)  
(6) INFORMATION DISCLOSURE STATEMENT